SNI

Standar Nasional Indonesia

SNI 1811-2007

Helmets for motorcycle users

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published in jakarta

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Foreword

SNI 1811-2007, Helmets for motorcycle users (Helm pengendara kendaraan bermotor roda dua) was prepared with the intention to ensure the quality of protective helmets available in the market, both regarding its construction and quality. By provision of this SNI standard it is expected that users shall be adequately protected since the helmets comply with safety requirements. Furthermore by publishing this SNI standard, domestic helmet manufacturers are encouraged to produce high protective standard helmets and enable them to compete with protection helmets produced by other countries. It is intended that helmets available in Indonesia comply with international performance specifications.

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SNI 1811-2007 is a revision of SNI No. 09-1811-1990, through adoption of international Rev. 1/add. 21/Rev.4 of E/ECE/324 and E/ECE/TRANS/505 Regulation No.22, uniform provision concerning the approval of protective helmets and visors for drivers and passengers of motor cycles and mopeds, BS 6658:1985, Protective Helmet for Motorcyclists, and JIS T 8133:2000, Protective Helmet for Drivers and Passengers of Motor Cycle and Mopeds.

This standard was prepared by Technical Committee “Basic Chemistry “ (Kimia Hilir) according to the process/ procedures of standards formulation and finally deliberated in a concensus meeting held in Jakarta on December 7th, 2004 and attended by technical committee members, consumers, manufacturers, testing laboratories and other related government institutions.

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Helmets for motorcycle users

1 Scope

This standard covers technical specifications of protective helmets intended for use by motorcycle users and passengers, including classification of open face and full face helmets.

2 Normative references

BS 6658: 1985 – *"Protective Helmet for Motor Cyclists", Specification".*

EN 960: 1994 – *"Headforms for use in the testing of protective helmets".*

ISO 6487: 2000, "*Road vehicles – Measurements techniques in impact tests – Instrumentation ".*

JIS T 8133 : 2000 – "*Protective Helmet for drivers and passengers of motor cycle and mopeds".*

Rev. 1/add. 21/Rev.4 24 September 2002 dari *E/ECE/324 dan E/ECE/TRANS/ 505 Regulation No.22, uniform provision concerning the approval of protective helmets and visors for drivers and passengers of motor cycles and mopeds.*

3 Terms and definition

3.1
protective helmet
a motorcycle accessory in the form of a protective headwear intended to protect the head of the user against a blow.

3.2
open face standard helmet
shape of a helmet that covers the head including part of the neck and covers the front side of the ear

3.3
full *face* standard helmet
shape of a helmet that covers the top of the head, part of the neck and mouth

3.4
shell
the hard and smooth material that forms the outer form of the helmet

3.5
protective padding
inner liner material attached to absorb impact energy

3.6
face cover
a section of the helmet that protects a part or whole part of the face and made from transparent sheet

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3.7
comfort padding
a soft material intended to provide comfort to the user

3.8
protective layer
a soft layer attached to the inner part of the helmet intended to provide comfort and protection the the head of the user

3.9
support device
support device assembly to retain the position of the helmet on the head

3.10
strap
a device of the helmet in the form of a strap with a fastening system to ensure the positon of the helmet

3.11
chin cover
part of the strap covering the lower part of the jaw of the helmet user, whenever the strap is in the locked position

3.12
peak
additional extension of the shell located above the eyes

3.13
lower face cover
an accessory forming a separate or removable section or a permanently attached section of the helmet protecting the lower part of the face

3.14
vent opening
an opening in the helmet to facilite air circulation within the helm

3.15
ear opening
an opening in the helmet close to the ears, to enable the user to hear whenever wearing a helmet

3.16
helmet net
an accessory of the helmet directly in contact with the head, having a fixed size or is adjustable by the user

3.17
basic plane of a human head
a plane passing at the level of the external ear opening and lower edge of the eye socket

3.18
reference plane of a headform
a plane relative to the headform that corresponds to the basic plane of the human head

3.19

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reference plane
a plane paralel to the basic plane of the headform and at a certain distance from the head plane corresponding to size of the headform

3.20
central vertical axis
a straight line relative to a human head or headform or helmet that lies in the plane of symmetry and that is normal to the basic plane at a point equidistant from the front and rear of the head or of the headform that simulates the head.

4 Quality requirements

4.1 General requirements

4.1.1 Materials

The helmet materials shall comply with the following specifications:
a. Made of strong non-metalic materials, shal not be adversely affected when exposed to a temperature of 0°C to 55°C in a open space for at least 4 hours and shall not be sensitive to ultraviolet irradiation, and shall not be affected by gasoline, oil, soap, water, detergents or any other cleaning materials;
b. The materials shall not deteriorate, be water resistant, or degrade due to temperature changes encountered;
c. Materials coming into contact with the skin shall not cause skin irritation or inflammation, and the materials shall not undergo alteration in its impact strength or any other physical properties change due to direct contact with sweat, oil or fat of the user.

4.1.2 Construction

The construction of the helmet shall comply with the following specifications:
a. The helmet shell shall have a hard and smooth external surface, a shock retention layer and chin straps,
b. The helmet shall be at least 114 millimeter high measured from the crown of the helmet to the main plane which is the horizontal plane passing passing at the level of the external ear openings and lower edge of the eye sockets,
c. The internal circumference of the helmet shall be as follows:

Table 1 Internal circumference requirement

Size	Internal circumference (mm)
S	Between 500 – and less than 540
M	Between 540 – and less than 580
L	Between 580 – and less than 620
XL	Over 620

d. The shell is made from hard material, of even thickness and homogenuous performance, shall not be reinforced locally and the face guard and eye protector should form separate parts,
e. The shock absorber consist of a impact absorber layer of at least 10 millimeters thick fitted to the interior of the shell, and a helmet net or any other construction intended as a helmet net,
f. Chin straps shall be at least 20 millimeters wide and shall be fitted with the intention to retain the helmet on the head of the user and provided with ear and neck covers,

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g. There shall be no rigid parts in the shell extending more than 5 mm high and every rigid projection shall be covered with soft padding and there shall be no sharp edges.

h. The longitudinal peripheral vision shall be at least 105° on each side and the vertical visual angle shall be at least 30° above and 45° below the main plane (see Figure 3a, 3b and 3c)

i. The helmet shall be fitted with ear protectors, neck cover, moveable visor, shield or chin cover.

j. The helmet protection region is as follows::

1. The shell shall cover all points above the AA' plane and at least extending to below the CDEF line at either side of the headform, see Figure 2
2. The protective layer shall cover all regions as specified in section (1) excluding other regions of the shell.

k. The helmet shall not impair the aura of the user against any danger. The ventilation openings are located in the shell to maintain the temperature in the space between head and shell.

l. Any projection due to a bolt /rivet edge shall be rounded and shall not protrude more than 2 mm from the surface of the shell.

m. The helmet shall be secured to the head of the user by straps engaged below the chin or by a strap under the chin that is fitted to the shell

1. Whenever the retention device is fitted with a strap of at least 20 mm wide and it shall withstand a static load of 150 N ± 5 N
2. The strap is not necessarily fitted with a chin guard
3. The mechanism incorporated to release the retention system shall be controlled intentionally. If the release device is operated by pressure, this mechanism shall not respond to the pressure of a 100 mm ball

n. Protector

1. Helmets fitted with a protector to be tested shall be placed on a headform with a size as specified
2. During placing the protector on top of the headform, the angle between the tangential RS line as shown in Figure 4 and the horizontal is at least 5° and R is located below the horizontal plane passing point S.

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4.1.2.1 Construction and parts of a helmet

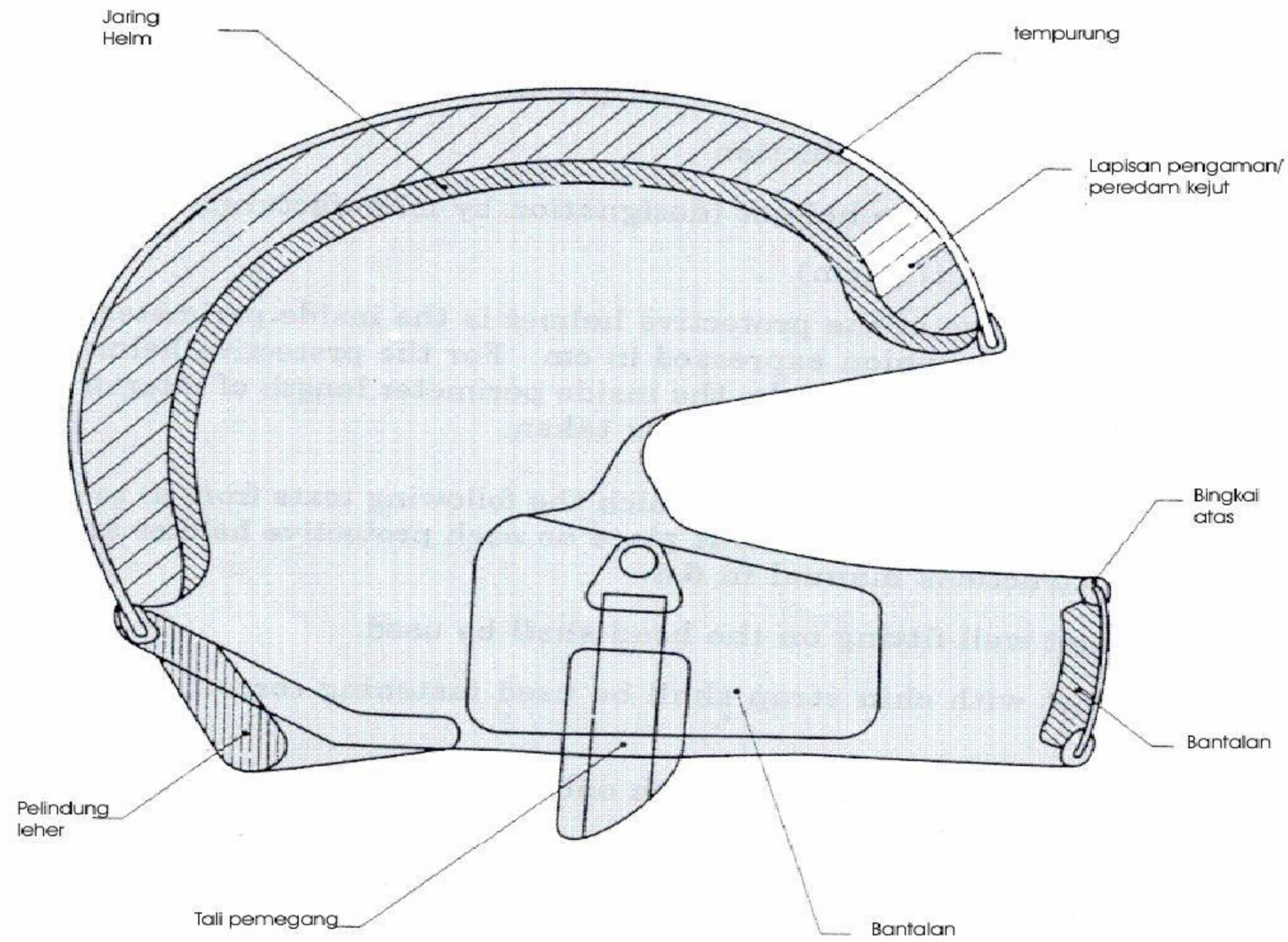


Figure 1a Construction and parts of a full face standard helmet

Tempurung = Shell
Lapisan pengaman/peredam kejut = Protective layer/shock absorber
Jaring helm = Helmet net
Bingkai atas = Upper rim
Bantalan = Padding
Tali pemegang = Strap
Pelindung leher = Neck protector

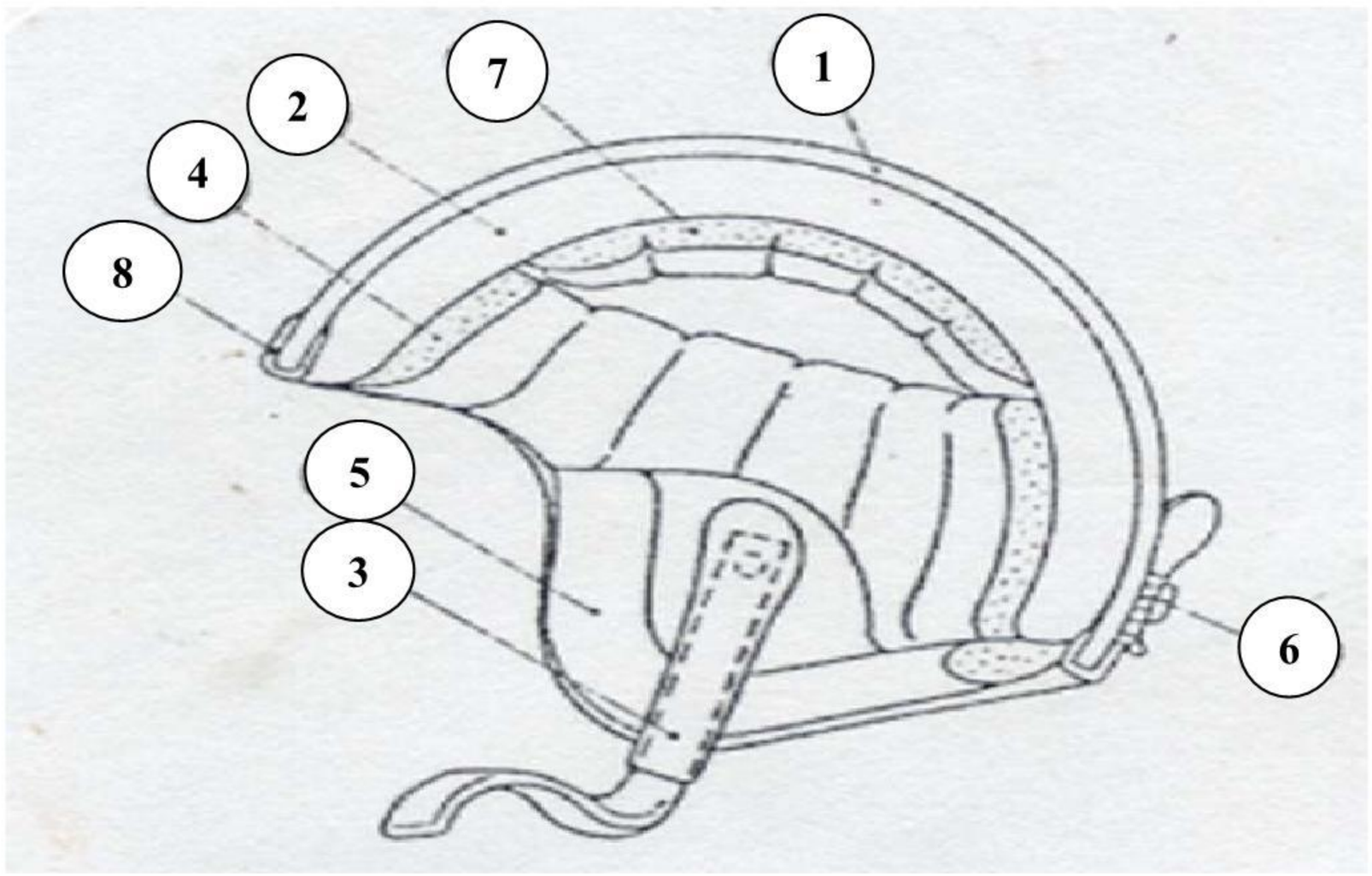


Figure notes

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1. shell
2. protection layer
3. strap
4. comfort padding
5. ear protector
6. glass hanger
7. helmet net
8. rim

Figure 1b Construction and parts of an open face standard helmet

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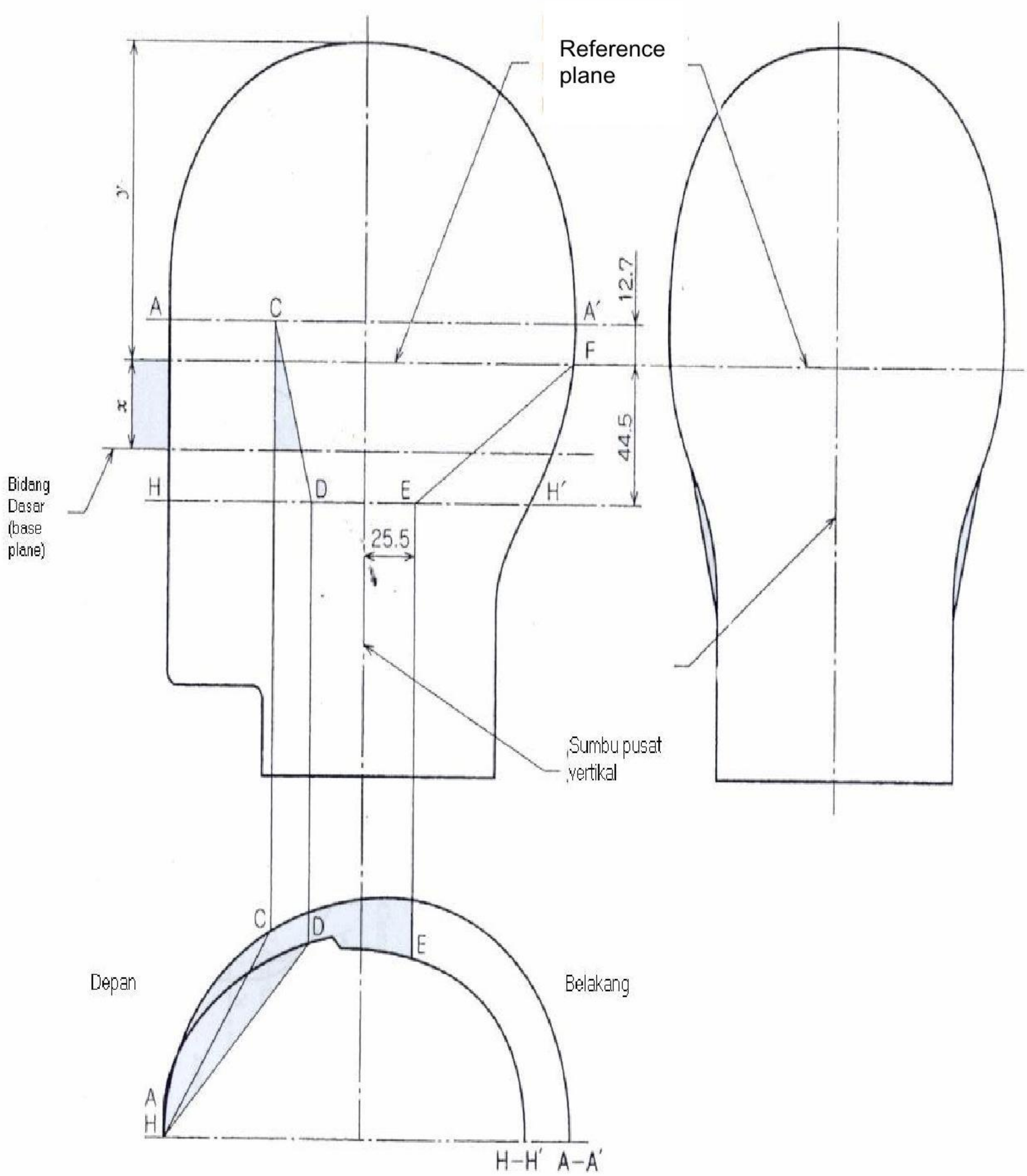


Figure 2 Protection section

Sumbu pusat vertikal = Central vertical axis
Bidang dasar = Base plane
Depan = Front
Belakang = Rear

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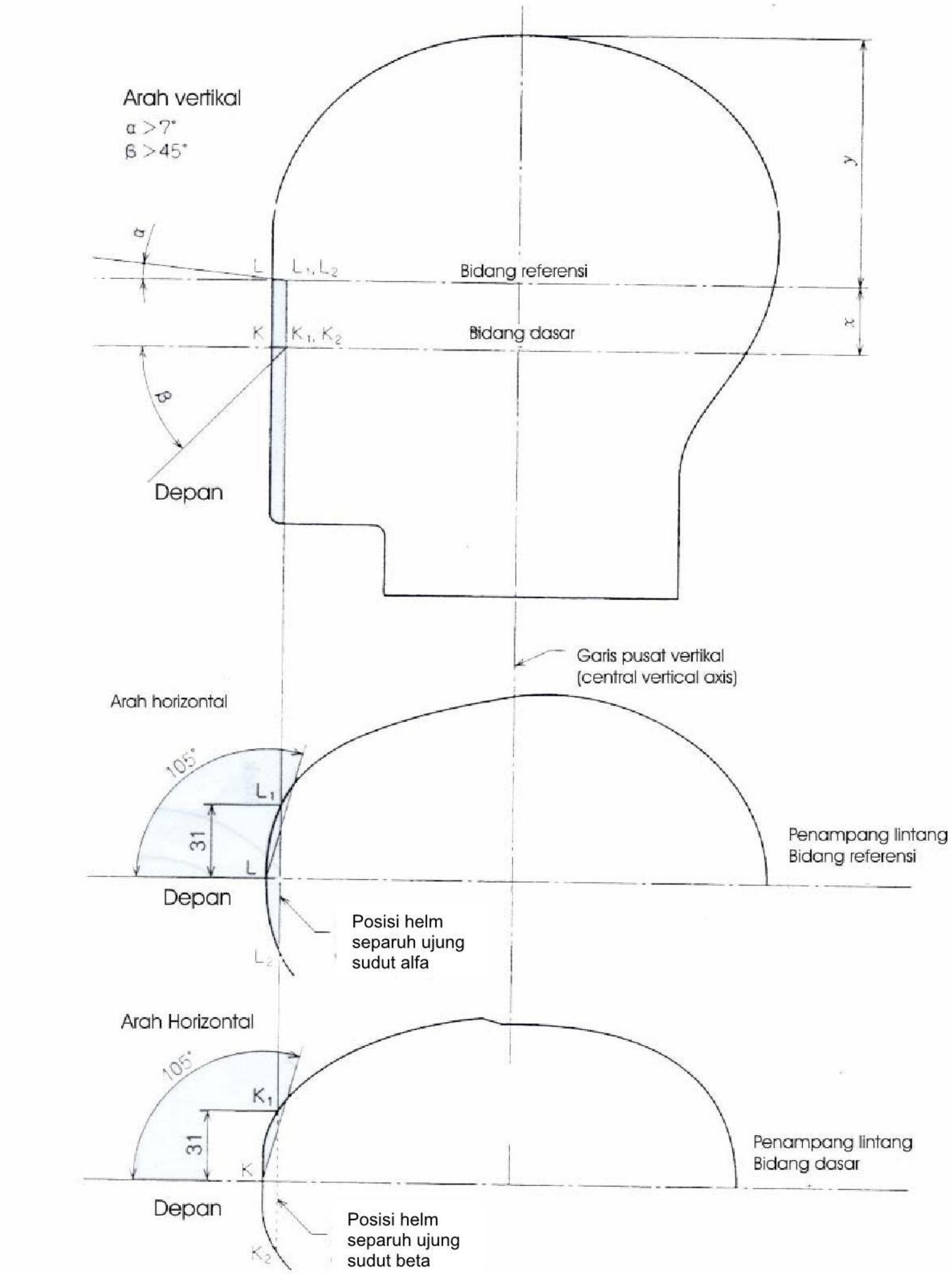


Figure 3a Peripheral vision

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Arah vertikal = Vertical direction
Depan = Front
Bidang referensi = Reference plane
Bidang dasar = Base plane
Garis pusat vertikal = Central vertical axis

Arah horizontal = Horizontal direction
Depan = Front
Penampang lintang bidang referensi = Reference plane longitudinal cross section
Posisi helm separuh ujung sudut alfa = Helmet position at half of alfa angle end
Penampang lintang bidang dasar = Base plane cross section
Posisi helm separuh ujung sudut beta = Helmet position at half of beta angle end

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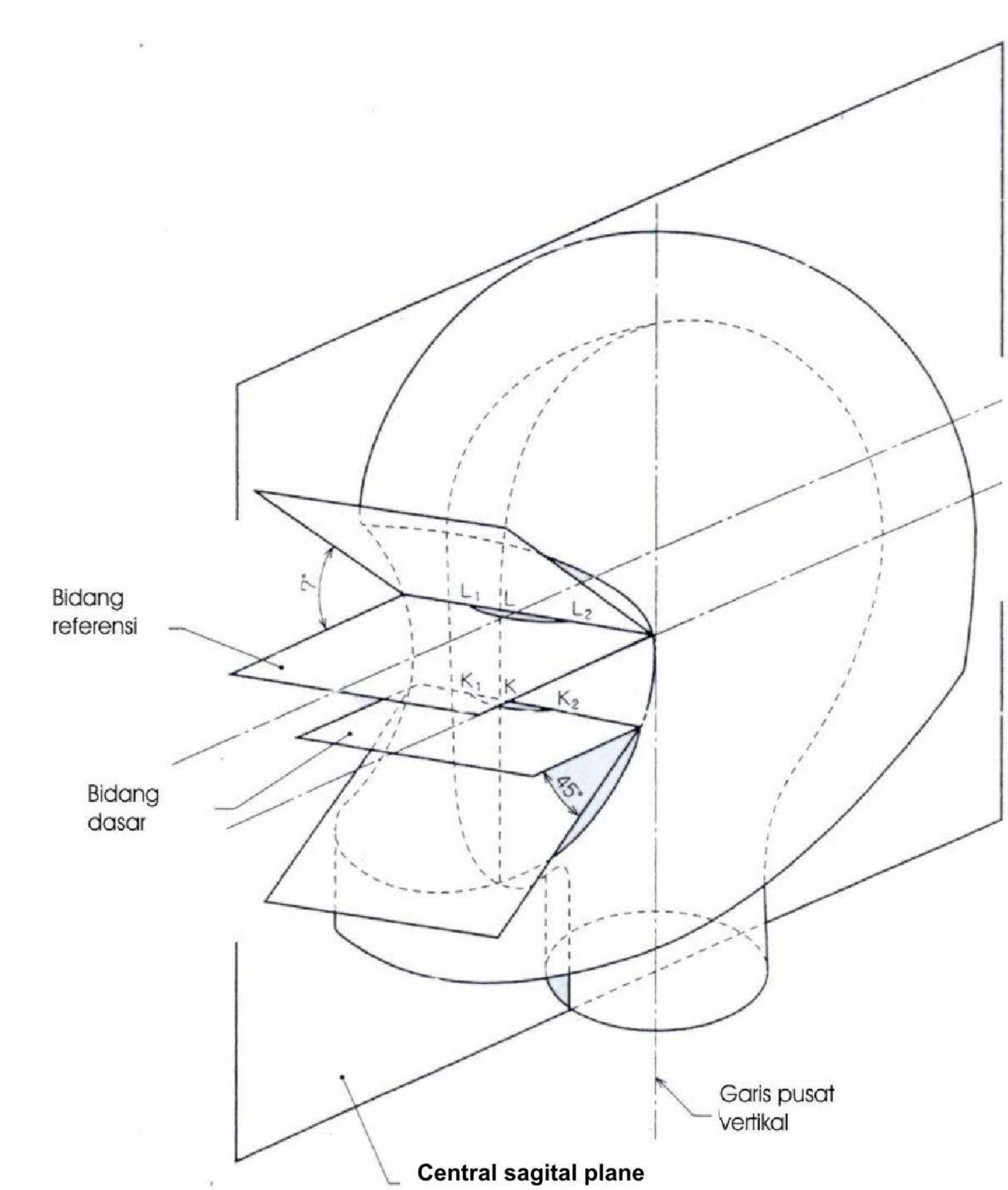


Figure 3b Peripheral vision – vertical direction

Bidang referensi = Reference plane
Bidang dasar = Base plane
Garis pusat vertical = Central vertical line

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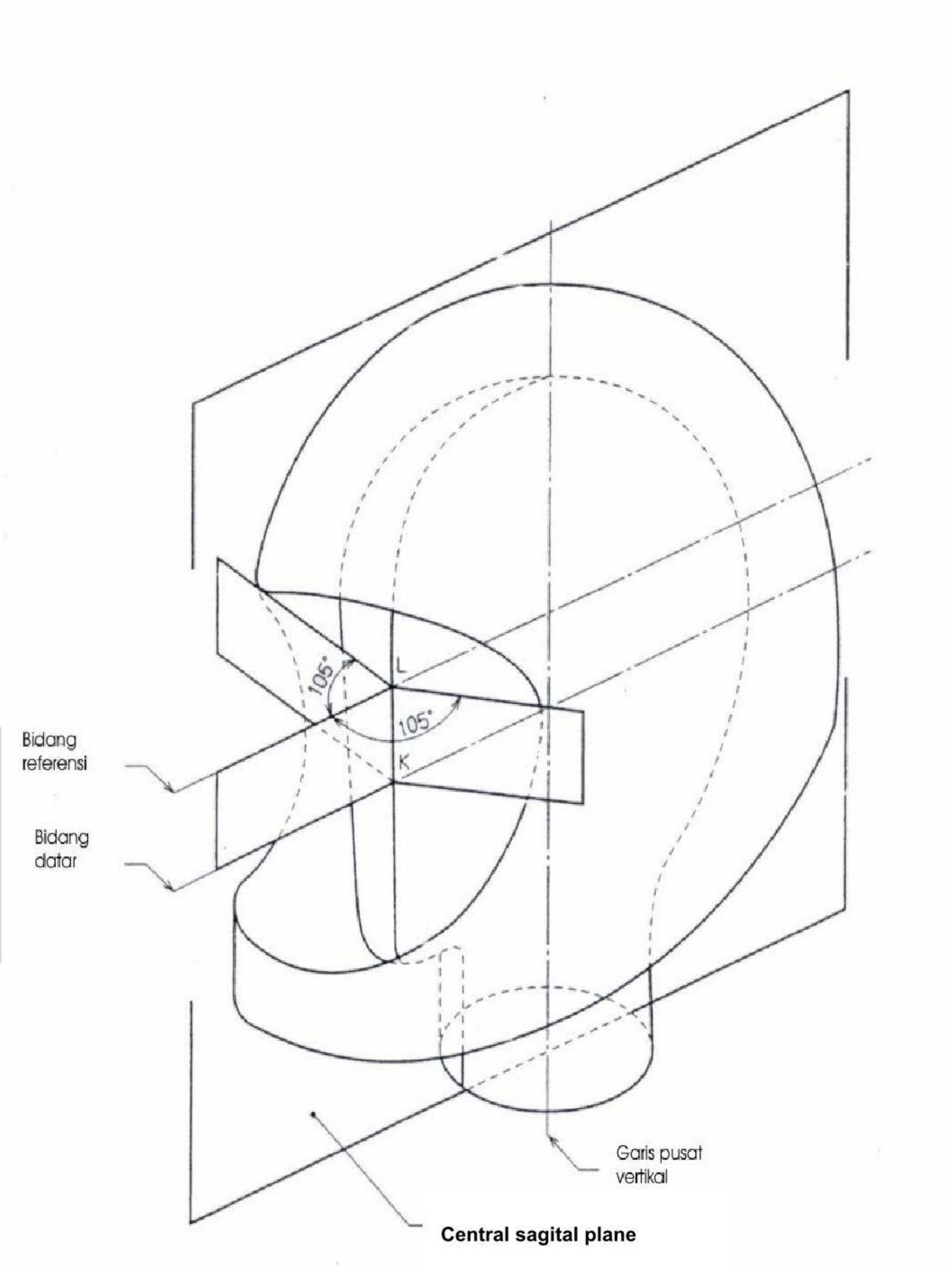
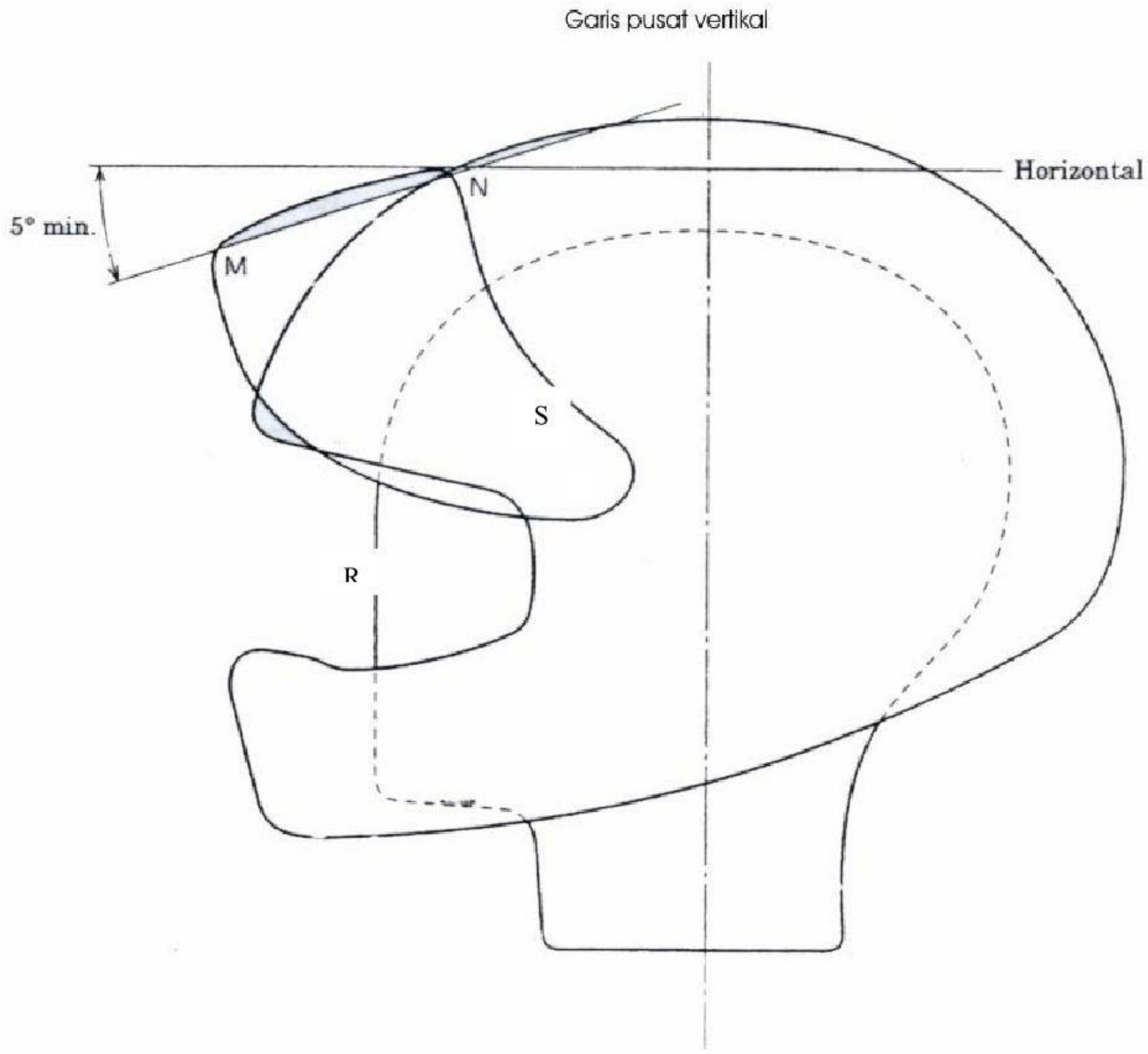


Figure 3c Peripheral vision – horizontal direction

Bidang referensi = Reference plane
Bidang dasar = Base plane
Garis pusat vertical = Central vertical r line

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Garis tangential MN merupakan garis lurus yang menghubungkan titik-titik ujung atas dan bawah dari pelindung pada bidang pusat sagittal (central sagittal plane) dari helm

Figure 4 Protector angle opening test

Garis pusat vertikal = Central vertical line
Horisontal = Horizontal

MN tangential line is a straight line that connects the upper and lower end point of the protector at the central sagittal plane of the helmet

4.2 Performance requirements

4.2.1 General

The helmets offered and for sale in the market shall be fitted and accompanied by various accessories separate from the original equipment. For tests specified in 4.2.2 (shell) and 4.2.3 (retention system), the samples shall be grouped into two sets consisting of three pieces and a set may consists of helmets of different sizes.
Six helmets comprising two sets shall include each shell size, at least one sample of the largest size helmet made with that size of shell.

4.2.2 Shell

4.2.2.1 Shock absorption

The maximum deceleration of the headform shall not exceed 300 *g*, when the shell is tested at various construction sections, it shall remain undamaged at the connection line located above the ACDEF line (see Figure 2), the test applied is as described in 6.2.

4.2.2.2 Penetration

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The striker shall not make contact with the test block at any point on the helmet, from its uttermost point down to the limit of rotation of the helmet on the test block, the test applied is as described in 6.3.

4.2.3 Retention system

4.2.3.1 Effectiveness of the retention system

The helmet selected as sample shall not come off the modified headform when tested by the procedure in 6.4.

4.2.3.2 Retention system relying on the chin strap

4.2.3.2.1 Retention system strength

The retention strap system shall have a dynamic permanent extension and a residual extension not exceeding 32 mm and 16 mm, respectively, after the first impact load, and 25 mm and 8 mm, respectively, after the second impact load, the test applied is described in 6.5.

4.2.3.2.2 Strap smoothness

The slip between the hard sections of the strap with a tension load applied through the grips shall not exceed 10 mm, when tested by the the method described in 6.6.

4.2.3.2.3 Strap abrasion

The strap shall not rupture and shall be capable of withstanding a tensile load of 3 kN if the slippage occurring is greater than 5 mm, the test applied is as described in 6.7.

4.2.4 Oblique impact resistance

4.2.4.1 Bar anvil

When the helmet is tested using a bar anvil, the peak longitudinal force shall not exceed 2,5 kN, nor shall its integral with time exceed 15,5 N.s, the test applied is as described in 6.8.

4.2.4.2 Abrasion anvil

If the shell is tested in more than one area using an abrasion anvil, the value of the peak force and its integral with time shall not differ from each area by a factor greater than 2,0 from a peak longitudinal force value not less than 1,75 kN, the test applied is as described in 6.8.

4.2.5 Chin guard

The chin guard is tested by reducing the maximum deceleration of the striker not exceeding 300*g*. The chin guard shall not develop or cause additional hazard to the user and any internal padding shall remain in place, the test applied is as described in 6.9.

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5 Sampling

Samples are taken at random, with at least 8 helmets from any lot and the sizes may vary. Increments of the number of samples are shown in Table 2 as follows:

Table 2 Number of samples

Number of helmets in a lot	Number of samples
Less than 1000 Over 100	minimum 8 maximum 16

6 Test method

6.1 Testing preparation

Prior to testing the samples shall be conditioned according to the following procedures

6.1.1 Ambient temperature conditioning

Maintain the helmet at ambient temperature of 25 ºC± 5 ºC and a humidity of 60 % ± 20 % for at least 4 hours

6.1.2 Solvent conditioning

Use a cotton cloth of 150 mm square and 25 ml solvent consisting of a mixture of 50:50 v/v iso-octane and toluene. Use the immersed cloth, wipe the whole external surface of the shell within an area of 50 mm from the strap in not less than 5 seconds. Repeat the procedure on the remaining external surface, including the strap and moisten this region in not less than 10 seconds. At least 30 minutes shall ellapse before further testing the influence of this solvent.

6.1.3 Conditioning at high and low temperature

Place the helmet in a test room, switch on a fan to provide effective circulation, touching the upper part of the helmet stand. Expose the sample to a temperature of 50 ºC ± 2 ºC and a temperature of -20 ºC ± 2 ºC for at least 4 hours and not more than 24 hours.

6.1.4 Water immersion conditioning

Immerse the helmet in inverted position in water at a temperature of 15 ºC ± 5 ºC for at least 4 hours and not more than 24 hours. Remove the helmet from the water, dry in an upright position for a period of not less than 15 minutes and not more that 45 minutes before testing.

6.1.5 Extent of shell and peripheral vision

Place the helmet on a headform appropriate to the size range of the helmet. The helmet shell front horizontal edge is positioned above the user's face, as far as permitted, parallel wih the base plane at the front and sides of the headform and then secure the helmet straps. Record the vertical distance at the front midpoint of the headform, between the base plane and helm edge above the face. Check the peripheral vision and visually estimate the extent of the shell area against the lines marked on the headform.

6.2 Shock absorption test

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6.2.1 Principle

The reduction of impact energy is determined from the deceleration of the test headform during guided free fall, the impact resulted when the surface. of the base plate is flat or hemishherical

6.2.2 Apparatus

The test apparatus is shown in Figure 5.
The headform of appropriate size for the helmet is placed in a headform support assembly. The support assembly may be guided in a vertical free fall with minimum friction unto an avil fixed to a hard base with a weight of at least 500 kg. The upper surface of the base consists of a steel plate at least 25 mm thick and a surface area not less than 0.1 m^2.
The headform may be rotated around a central axis for any area of the helmet with respect to the hard anvil. A deceleration transducer is fitted in the center of gravity of headform and support assembly with a sensitivity of 5^o to the vertical axis.

The center of gravity of the headform and support assembly is positioned in a 10^o cone with a central vertical axis and its top is located at the impact point.

The total weight of the test assembly is 5 $^{+0,2}_{-0}$ kg excluding the helmet weight itself and the total weight of the support assembly shall not exceed 20% of the total weight of the drop assembly. The flat anvil has an impact circle surface diameter of 130 mm ± 3 mm, a hemispherical anvil shall have an impact circle surface radius of 50 mm ± 2 mm.
The drop speed of the drop assembly shall be measured at a distance within 60 mm from the impact point with an accuracy of ± 1 %. The deceleration transducer shall withstand an impact of 2000 *g*. .
The measurement system including the drop assembly shall comply with requirements for channel class 1000 of ISO 6487: 2000, *Road vehicles – Measurements techniques in impact tests - Instrumentation.*

6.2.3 Procedures

6.2.3.1 Apparatus check

Check the measurement system before commencing the helmet tests by impacting the test sample mounted on the headform from a fixid height, to obtain a deceleration of 300 *g*.
Record at least 3 values on each impact observation, and these results shall lie within a range of ± 15 *g*.

6.2.3.2 Test sequence

Test two sets, each consisting of 3 helmets using the sequence given in Table 3. Test every helmet according to the procedures described in 6.2.3.3 at three different impact test points, with a distance of not less than 1/5 of the maximum circumference of the helmet and located as follows:

a. Front or side, on or above the AA' line as explained in 6.3.3.4
b. At any other site above the AA' line
c. In front of the perimeter BB' as explained in 6.3.3.4

Apply impact to the front and rear sections of the helmet at a distance of 25 mm of the center longitudinal axis of the headform, and apply impact to the helmet sides at a distance not more than 25 mm of the transverse plane through the central vertical axis of the headform.

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6.2.3.3 Time schedule

For temperature conditioned helmets, apply the first load test on each helmet, as described in 6.2.3.4, approximately 40 ± 5 seconds after its removal from the conditioning room.
For immersion conditioned helmets, apply a complete test for shock absorption such as penetration and retention system strength test within 60 minutes of completing the drying procedure.

Table 3 Test sequence

Set No.	Helmet No.	Conditioning	Anvil face shape
Set 1	1 2 3	High temperature Low temperature High temperature or water immersion	Hemispherical Hemispherical Hemispherical or flat
Set 2	4 5 6	High temperature Low temperature Low temperature or water immersion	Flat Flat Hemispherical or flat

6.2.3.4 Testing

Mark line AA' and circumference BB' on the external surface of the helmet. The AA' line on the helmet is the line where the outer surface of the helmet intersects the horizontal plane AA'.
The circumference BB' on the helmet is the line on the external surface of the helmet that intersects cone ZBB' generated by rotating line ZB (see Figure 2) up to 360° about an axis coincident with the central vertical axis of the helmet.
The ZB line is a line sloping upwards at an angle of 20° to the horizontal from the point Z.
After conditioning, fasten the helmet on the headform, lock the headform in position required for the impact side at the anvil.
Apply two impacts on the same location using the same anvil.
If necessary the helmet on the headform may be adjusted after the first impact to ensure that the next impact is on the same location. For each impact use a drop height in order that the impact test strikes the anvil with the desired velocity with a tolerance of $^{+0,15}_{-0}$ m/sec. as specified
Measure the velocity of the impacting mass. Record the deceleration against time.

Table 4 Impact velocity

Impact	Anvil face shape	Impact velocity (m/second)
First impact	Flat Hemispherical	6,5 6,0
Second impact	Flat Hemispherical	4,6 4,3

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6.3 Penetration test

6.3.1 Principle

The pointed spike device is dropped onto the upper part (top) of the helmet When the pointed spike penetrates the headform inside, the helmet is rejected.

6.3.2 Apparatus

The appropriate apparatus is shown in Figure 6a and 6b.
A hemispherical hard wood test block with a soft metal insert at the top of the central axis is mounted on a rigid base. The helmet is fitted with straps to secure it.
At pointed spike is mounted, so that the spike may be dropped with substantial friction onto the center of the soft metal insert.
Electrical contact between the spike and soft metal insert may be indicated by an electrical indicator. The spike has the following characteristics:

Mass 3,0 kg $^{+45}_{-0}\ gram$;

Included angle of the spike 60° ± 0,5°;
Tip radius 0,5 mm ± 0,1 mm;
Minimum height of cone 40 mm;
Hardness of tip 50 - 45 Rockwell – C scale

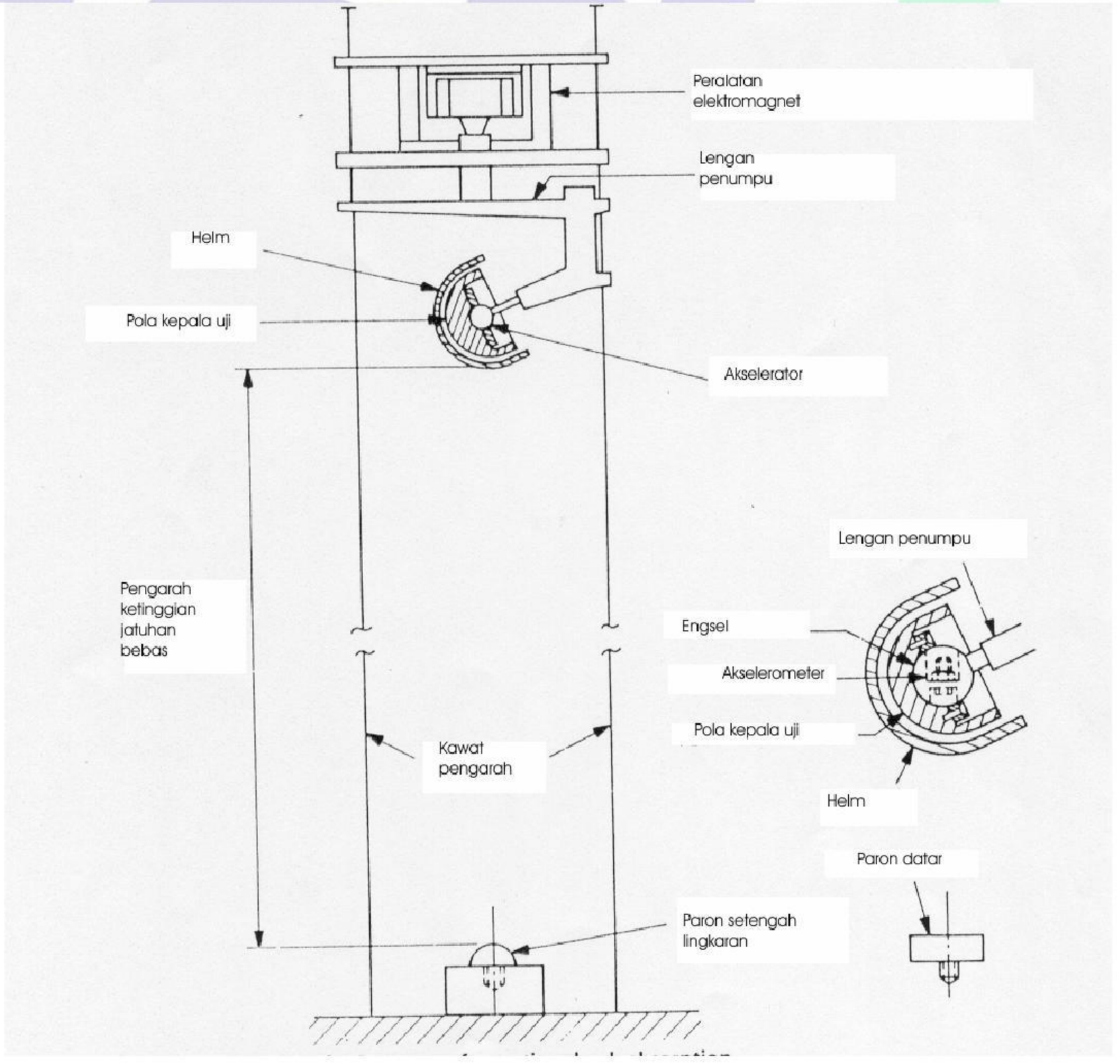


Figure 5 Impact retention test equipment

Peralatan elektromagnet = Electromagnetic device
Lengan penumpu = Supporting arm
Helm = Helmet
Pola kepala uji = Test headform
Akselerator = Accelerometer
Pengarah ketinggian jatuh bebas = Free fall height guide
Kawat pengarah = Guide wire
Paron setengah lingkaran = Hemispherical anvil

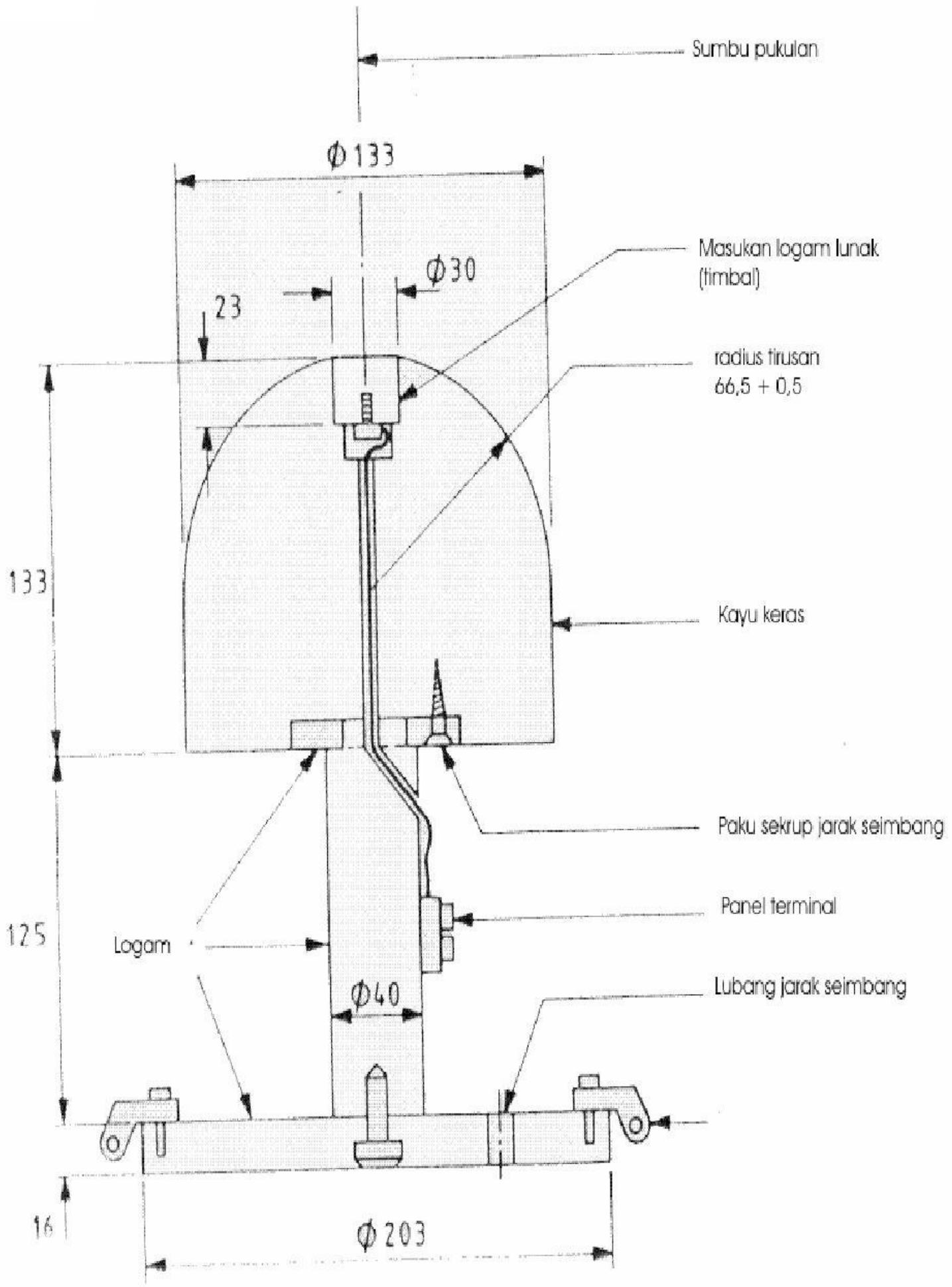
Lengan penumpu = Support arm
Engsel = Hinge
Akselometer = Accelerometer
Pola kepala uji = Test headform
Helm = Helmet
Paron datar = Flat anvil

6.3.3 Procedure

Secure the helmet firmly unto the test block by tying the straps across the top of the helm. Drop the striker for free fall from a height of 1,6 m ± 5 mm (measured from the striker bar to the impact spot) onto the helmet at two sections separated by a distance not less than 75 mm from the center of impact location used for the impact retention test. Record whether or not an electrical contact exsist between the striker and soft metal on the test block. After every impact, whenever necessary, the initial form of the flat soft metal is restored.
For conditioned helmets by water immersion, the penetration test should be supplemented with an impact retention and resistance system strenght test within 60 minutes to complete the drying procedure.

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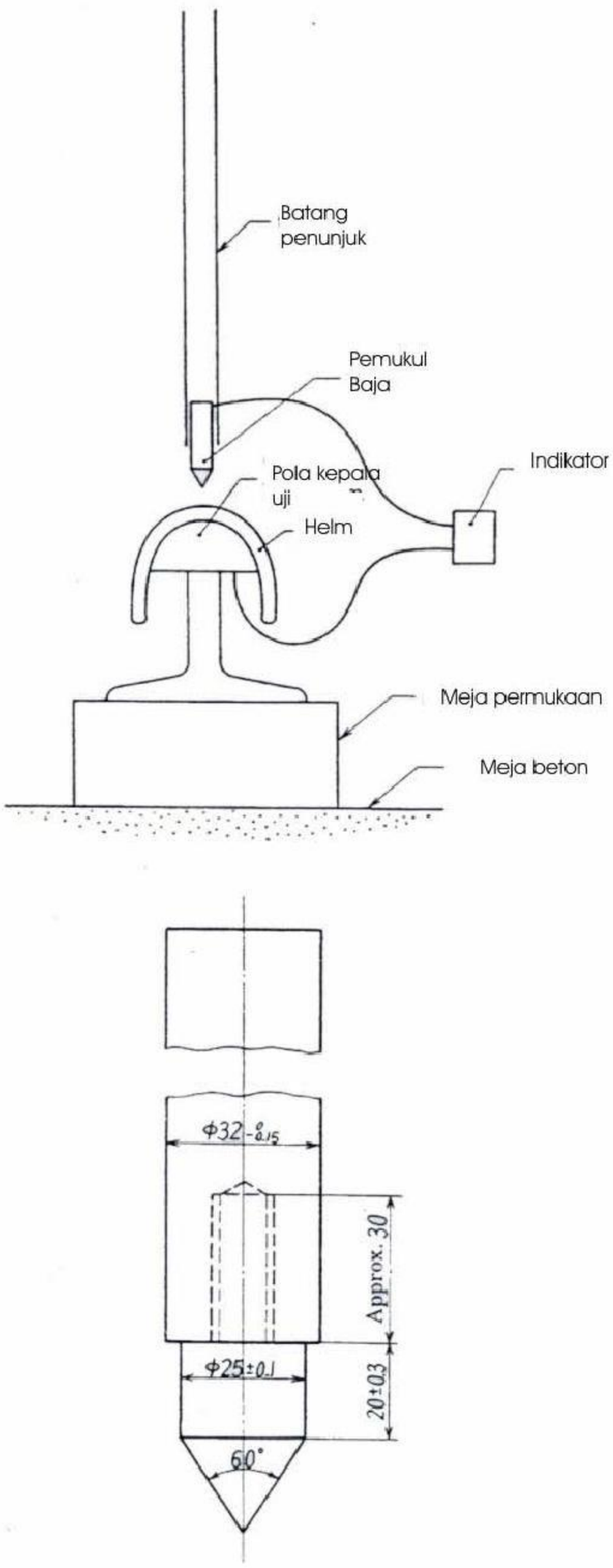
Satuan dalam mm

Tolerance ± 1

Figure 6a Headform shape for penetration resistance test

Sumbu pukulan = Striker axis
Masukan logam lunak (timbal) = Soft metal insert (lead)
Radius tirusan 66.5 ± 0.5 = Spherical radius 66.5 ± 0.5
Kayu keras = Hard wood
Paku sekrup jarak seimbang = Screw for equilibrium distance
Panel tombol = Switch panel
Logam = Metal
Lubang jarak seimbang = Equilibrium distance hole
Satuan dalam mm = Units in mm

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Pemukul baja untuk uji ketahanan penetrasi
Catatan: Batang harus R0,5 + 0,1

Figure 6b Test block for penetration resistance test

Batang penunjuk = Indicator bar
Pemukul baja = Steel striker
Indikator = Indicator
Pola kepala uji = Test headform
Helm = Helmet
Meja permukaan = Surface table
Meja beton = Concrete table
Pemukul baja untuk uji ketahanan penetrasi = Steel striker for penetration resistance testing
Catatan: Batang halus R0.5 + 0.1 = Note: Rod surface roughness R0.5 + 0.1

6.4 Retention system effectiveness test

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6.4.1 Principle

The helmet mounted on the modified headform by means of its retention system is subjected to an impact load in a forward direction at the top of the helmet, which simulate the inertial stiffness of the helmet to lift and roll forward over the user's face when the user stops suddenly.

6.4.2 Equipment

6.4.2.1 Modified headform

The modified headform is shown in Figure 7. Prior to modification the headform complies to size G (interior circumference is 560 mm ± 0,25 mm). The part of the headform down to the LCEH' line (See Figure 7) is covered by artificial acrylic hair cut to a length of 70 mm simulating a human head of hair. The point L is 40 mm above the AA' line, and the point H' is located on the backward extension of the DE line (see Figure 2). The circumference of the headform outside the artificial hair is 575 ± 5 mm which lies within $^{+0}_{-10}$ mm of the circumference of the headform which the helmet is to fit and corresponds to size K (internal circumference is 580 mm ± 0,25 mm).

NOTE The headform size G, K or J complies with EN 960 :1994, *Head form use in the testing of protective helmet.*

The neck of a standard headform is lengthened by 50 mm. The front of the throat and the underside of the jaw are replaced by polyethylene foam of a density of 40 kg/m^3. The foam extends 12 mm below the chin of the unmodified headform, while above and to the rear it is bordered by two planes perpendicular to the longitudinal vertical plane.
One boundery plane is vertical and located 30 mm in front of the neck, while the other is sloping upward towards the rear of the headform at an angle of 70° with repect to the vertical and passes through the point of the chin of the unmodified headform.
A dummy collar bone is firmly fixed to the front of the neck at the base. The dummy is made of rectangular block of wood 16 mm ± 1 mm thick protruding 40 mm ± 1 mm from the cut-away front of the neck and with its lower face coplanar with the base of the neck.(see Figure 7)

6.4.2.2 Testing accessories

The appropriate accessories for testing retention system effectiveness are shown in Figure 8. The modified headform is rigidly mounted, facing downward with its central vertical axis sloping downwards 45 ° below the horizontal.
A drop weight with a mass of 4 $^{+0,2}_{-0}$ kg is able to slide freely on two adjacent vertical slide wires close to the crown of the headform. The drop weight is connected to a hook by a flexible strap 0,9 m ± 0,1 m long which increases in lenght by at least 18 mm when subjected to a tensile load of 1000 N.

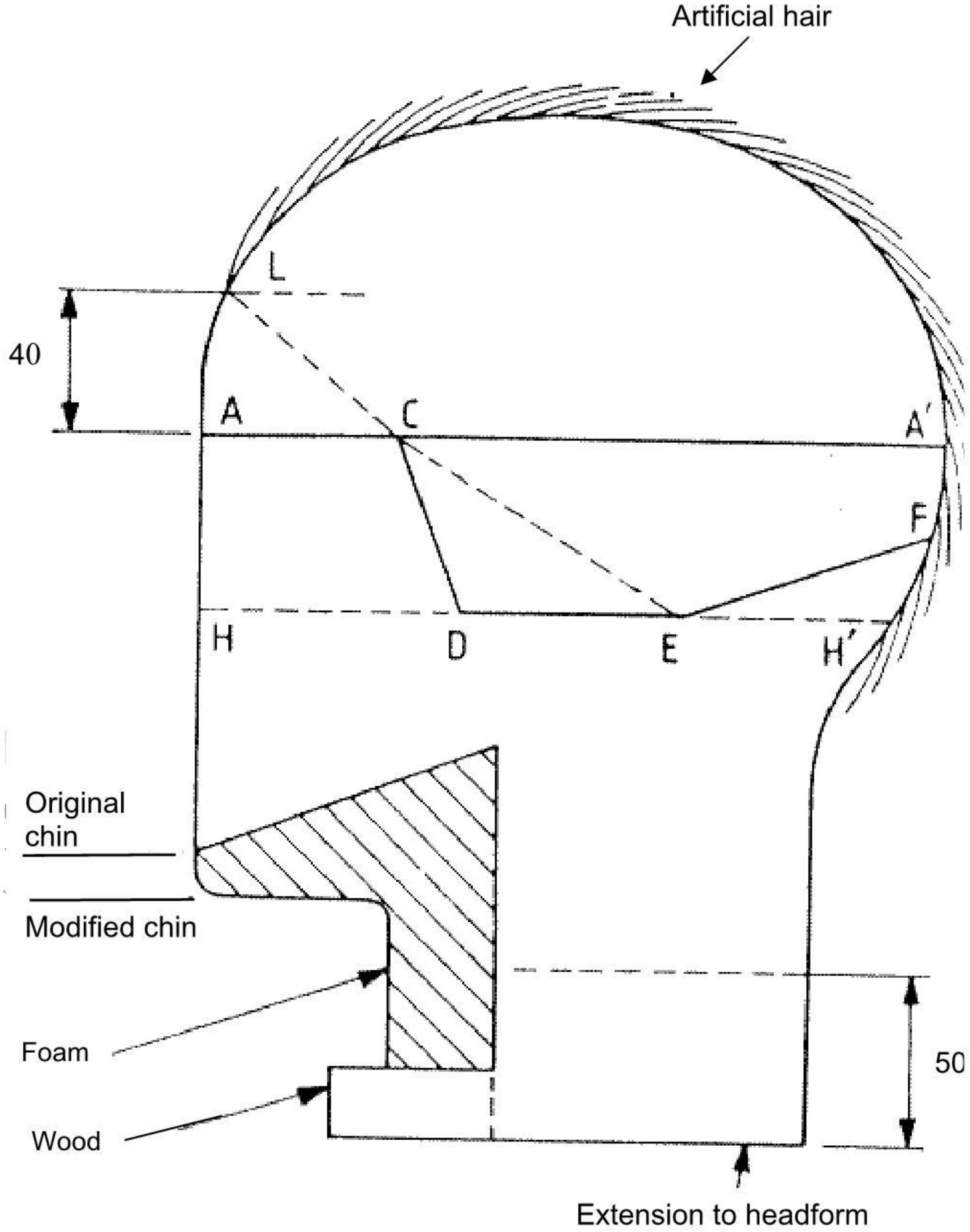
6.4.3 Procedure

Take a helmet of size K, and check its internal dimensions using a suitable instrument such as a hatter's band. The helmet should have an internal circumference of at least 580 mm and an internal length of at least 204 mm.
Mount the helmet on the modified headform (6.4.2.1) in the rig (See Figure 8) and fasten the retention system. If there is no strap, or there is more than one chinstrap, fasten the retention sytem in accordance with the manufacturer's instruction. Adjust the retention system so that it compresses the chin or neck foam by 5mm ± 1 mm. Increase the drop weight and engage

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the hook in the center of the rear edge of the helmet and drap the strap over the crown of the helmet, keep the strap and hook in the longitudinal vertical plane. Release the weight from such a point that it falls through 1 $^{+0,1}_{-0}$ m before the strap becomes tigthened. Repeat the drop twice or more, readjust the retention system before each drop.
Observe whether the helmet rolled forward off the headform and if possible note those factors in the desain or behaviour of the helmet which contribute to the success or failure of this test.

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All units in mm

Figure 7 Modified headform

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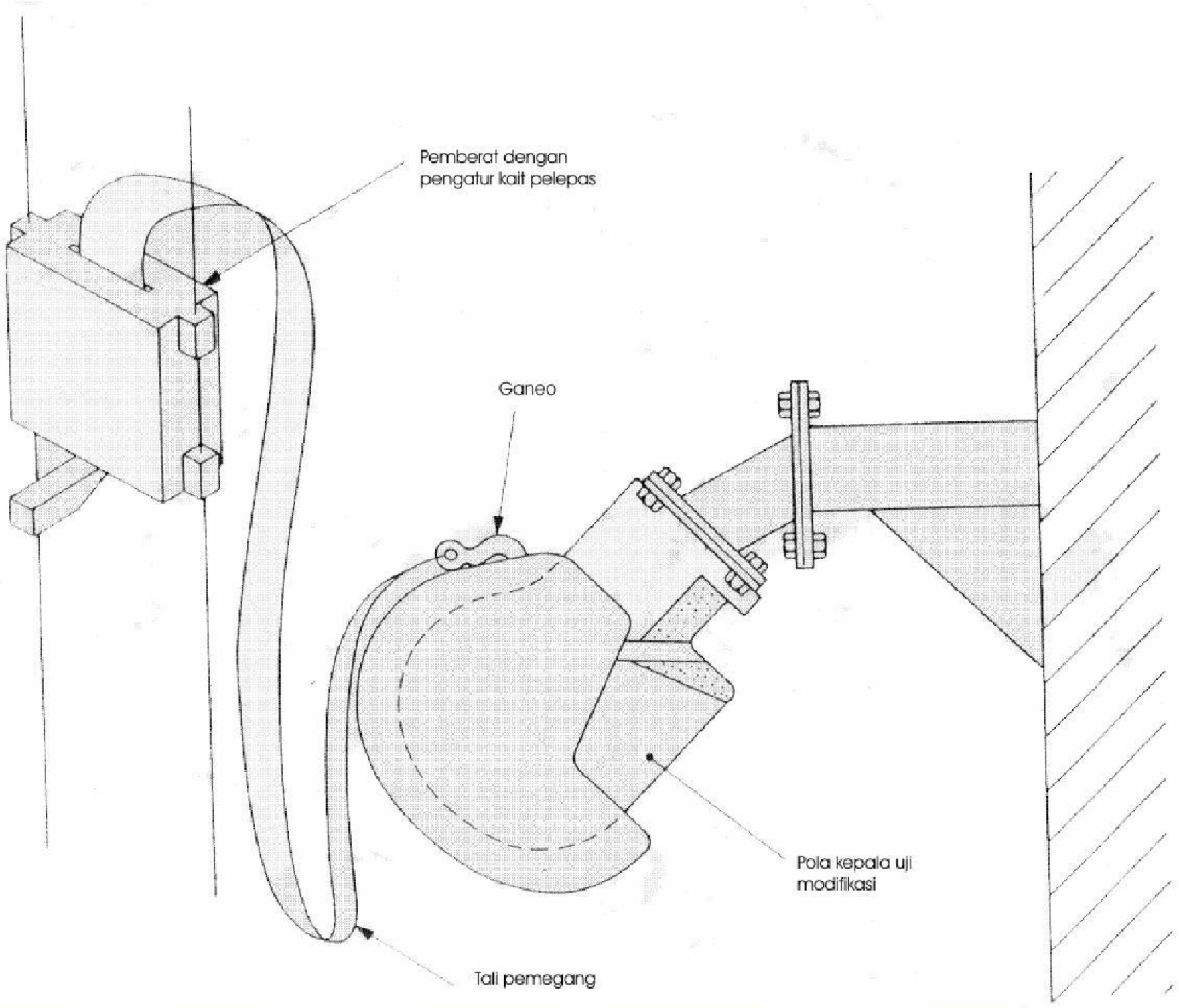


Figure 8 Apparatus for testing the effectiveness of the retention system

Pemberat dengan pengatur kait pelepas = Weight with adjustable release hook
Ganco = Hook
Pola kepala uji modifikasi = Modified headform
Tali pemegang = Attachment strap

6.5 Test for strength of retention system with chin straps

6.5.1 Principle

A downward shock load is applied twice to the chin straps on a helmet. The dynamic and static extensions and slippage of the strap are observed.

6.5.2 Apparatus

The appropriate apparatus are shown in Figure 9.
A support is provided for the base rim of the helmet under test and an additional support is provided for a headform.
Below the strap position a guide bar is mounted in guides which maintain it in a vertical position while permitting vertical movement with a slight friction. The upper end of the bar carries two parallel horizontal rollers capable of free rotation, each with a diameter of 12,5 mm ± 0,5 mm and a distance between centres of 76,0 ± 0,5 mm. Means are available for measuring both the maximal dynamic vertical extension and the static vertical extension of the chin strap looped under the rollers.

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This is achieved by attaching to the guide bar a displacement transducer and an indicator against a fixed vertical scale.
A anvil having a horizontal upper surface is covered with a foam pad 10 mm ± 2 mm thick is rigidly mounted on the guide bar.
A drop weight of mass10 $^{+0,25}_{-0}$ kg can be slid upwards along the bar and dropped onto the anvil with slight friction through a distance of at least 750 mm.
The total mass of the guide bar and all its attachments excluding the drop weight is 7,0 $^{+0}_{-0,25}$ kg.

6.5.3 Procedure

Place the helmet with its base on the helmet support and adjust the headform to steady the helmet in such a position, that when the fastened chin strap is pulled downward vertically it lies in the same vertical plane as the guide bar.
By lifting the drop weight, the chin strap is fastened under the rollers so that the chin strap support the weight of the guide bar and the anvil, and the buckle is not in contact with the rollers.
It is recommended that the rollers should be approximately 130 mm below the headform reference line.
Read or set to zero the static extension measuring device and mark the position of the buckle on the chin strap. Drop the weight unto the anvil through a height of 750 mm ± 5 mm, including the thickness of the foam pad. Read the peak dynamic extension and repeat readings while the drop weight rest on the anvil, or read and set to zero the static extension measuring device.

NOTE Extension includes any slippage of the buckle.

Without disturbing the helmet or chin strap, raise the drop weight and repeat the impact.
Read the peak dynamic extension and the static extension for each impact separately and the total slippage of the buckle.
For water immersion conditioned helmets, complete the test for retention system strength as well as those for shock absorption and penetration test within 60 minutes of completing the drying procedure.

6.6 Test for chin strap slippage

6.6.1 Principle

Tension in the strap is repeatedly applied and relaxed. Progressive movement of the fastener along the strap is observed.

6.6.2 Apparatus

The appropriate equipment is shown in Figure 10.
The apparatus consists of a flat horizontal smooth base plate, a weight for applying a load, roller that moves freely horizontally with a diameter not less than 20 mm, and in the same horizontal plane as the top of the roller, a clamp capable of reciprocating the horizontal motion at a certain angle to the roller axis with a total amplitude of 50 ± 5 mm at a frequency between 0,5 Hz and 2,0 Hz.

6.6.3 Procedure

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Take a sample of the strap 300 mm long, including the tensioning, adjusting and tightening devices of any additional strap. Fix the upper end of the strap to the clamp level with the top of the roller and drap the strap over the roller. Attach a weight to the lower end of the strap so that when the weight is lifted by the strap a tension of 20 ± 1 N is imposed. Adjust the equipment so that when the reciprocating clamp is at the centre of its motion, the weight is just resting on the base, the strap is almost tensionless and the strap buckle is between the clamp and roller and will not touch the roller during reciprocation. Operate the reciprocating clamp for 20 cycles. Record the position of the components on the strap. Operate the reciprocating clamp for 500 cycles and record the distance through which the components have slipped along the strap.

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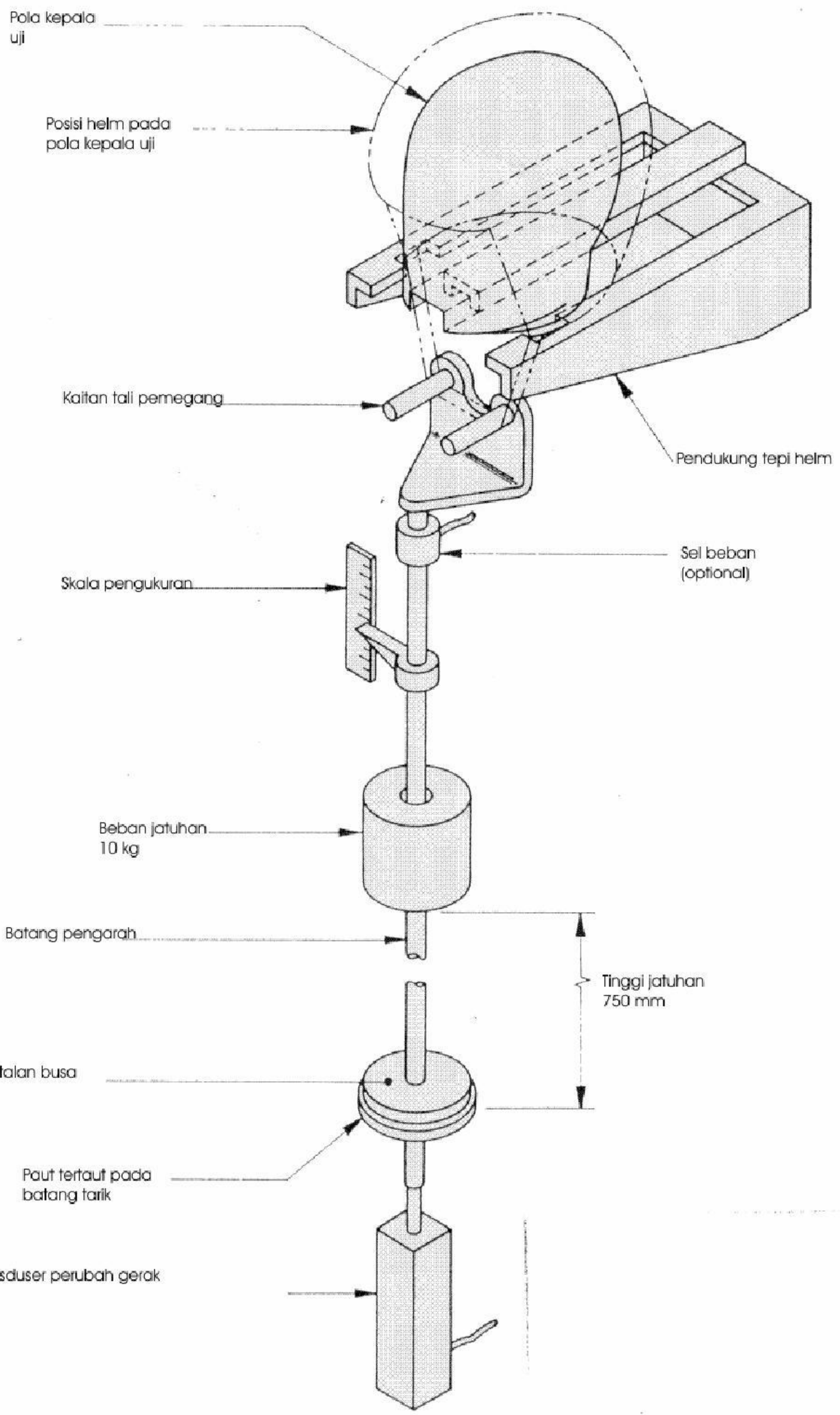


Figure 9 Apparatus for testing retention system strength with a chin strap

Pola kepala uji = Headform
Posisi helm pada pola fepala uji = Helmet position on the headform
Kaitan tali pemegang = Chin strap stirrup
Pendukung topi helm = Helmet support
Sel beban (optional) = Load cell (optional)
Skala pengukuran = Extension scale
Beban jatuhan 10 kg = 10 kg drop weight

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Batang pengarah = Guide bar
Tinggi jatuhan 750 mm = 750 mm drop height
Bantalan busa = Foam pad
Paron tertaut pada batang tarik = Anvil attached to the tension rod
Transducer perubah gerak = Displacement transducer

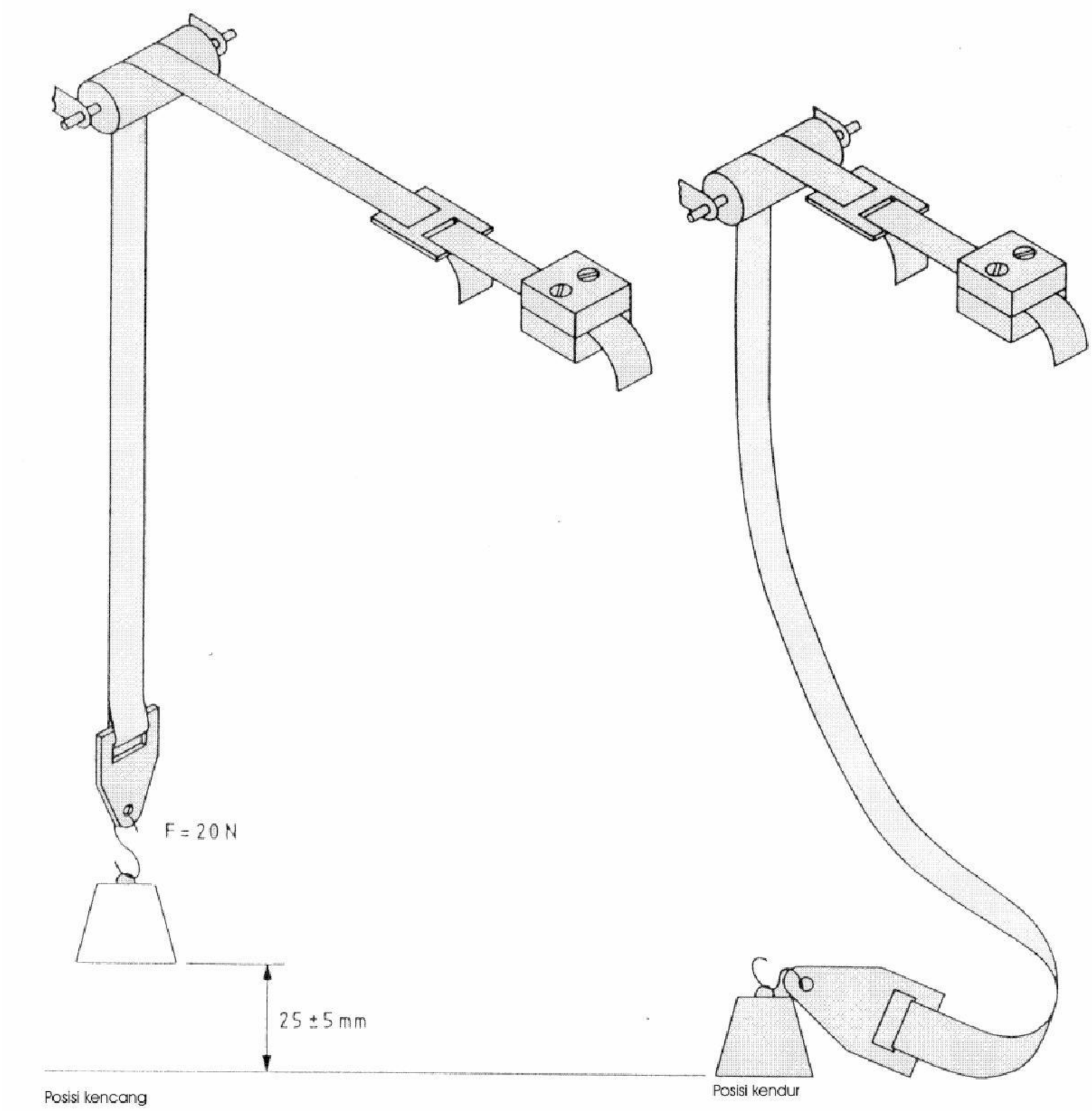


Figure 10 Apparatus for testing slippage of the chin strap

Posisi kencang = Stretched position
Posisi kendur = Slack position

6.7 Test for resistance to abrasion of the chin strap

6.7.1 Principle

The strap is repeatedly slid through its adjuster or fitting and the abrasion of the strap by the adjuster or fitting is determined by a tensile strength test.

6.7.2 Apparatus

The suitable apparatus is shown in Figure 11. This apparatus has an amplitude of motion of 100 ± 10 mm and the strap passes over a certain surface or strap fitting through an appropriate angle.

6.7.3 Procedure

Select the setting of apparatus for a particular design of both the strap and the fitting, likely to cause abrasion of the equipment. Tie up one end of the strap in the oscillating clamp, arrange the strap through the fitting as designed and attach a weight on the end to tension the strap with a force of 20 N. Mount or prepare the fitting in a certain position so that the oscillation of the clamp slides the strap through the fitting, simulating slippage of the fitting on the strap when the helmet is on the head.

Oscillate the clamp for a total of 5 000 cycles at a frequency between 0,5 Hz dan 2 Hz.

Mount the strap to be tested for its abrasion in a tensile testing machine using clamps to avoid local damage to the strap, so that the length of the strap including the part that shows wear between the clamp is 150 ± 15 mm. Operate the machine to stretch the strap at a speed of 100 ± 20 mm/minute until the tension in the strap is 3 kN (or to prior failure).

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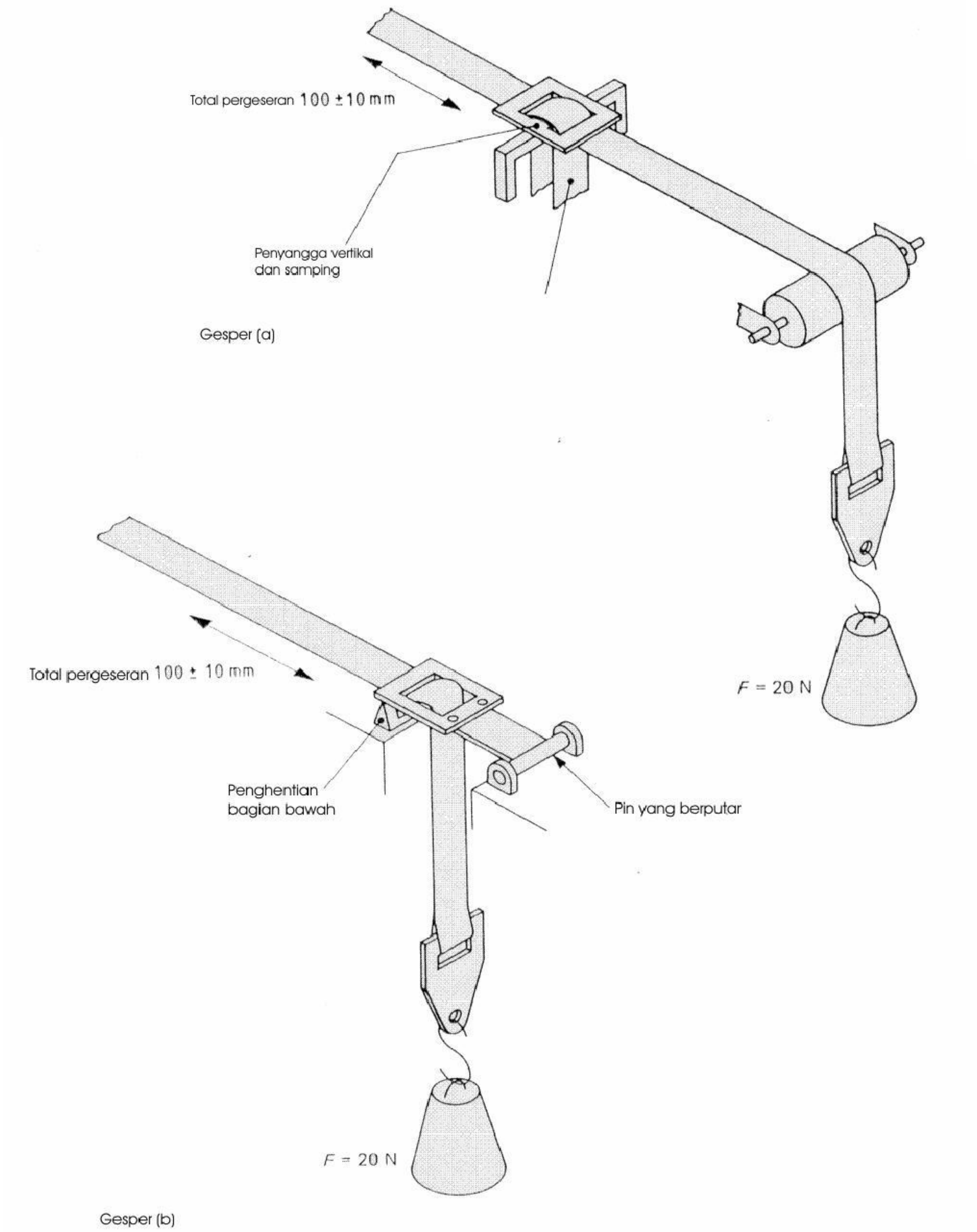


Figure 11 Apparatus for testing the abrasion of the chin strap

Total pergeseran 100 ± 10 mm = Total sliding 100 ± 10 mm
Penyangga vertical dan samping = Vertical and lateral support
Gesper (a) = Buckle (a)
Total pergeseran 100 ± 10 mm = Total sliding 100 ± 10 mm
Penghentian bagian bawah = Lower stop
Pin yang berputar = Rotating pin
Gesper (b) = Buckle (b)

6.8 Oblique impact test

6.8.1 Principle

The rotation-induced forces obtained when a helmet placed on a headform is dropped vertically onto an inclined anvil are measured in the longitudinal axis of the anvil.

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Both the peak force and its integral with time over the duration of the positive impulse are used as performance criteria.

6.8.2 Apparatus

A suitable apparatus is shown in Figure 12. This is comparable to that used for the impact absorption test, except that the helmeted headform is suspended by a strong strap and is free to rotate and the anvil is inclined. The the headform is a headform complying with size J, and of mass $5\,^{+0,2}_{-0}$ kg, and is effectively of uniform density.

The equipment has a rigid base having a mass of at least 500 kg and a surface area of at least 0,1 m². The anvil is mounted securely at an angle of 15° to the vertical with the provision for prior and post adjustment.

The anvil shall have a minimum width of 200 mm and is adaptable to carry two different impact surfaces as follows. The bar anvil consist of a series of at least 5 horizontal bars at 40 mm centres.

Each bar is made from a 6 x 25 mm steel strip with an end radius of 1 mm and the bottom face is chamfered at an angle of 15° so that, as mounted, the upper edge of each bar is fully exposed from vertically above.

The bars are case hardened to a depth of approximately 0,5 mm. The abrasion anvil is a base covered by a 80 grade aluminium oxide abrasive sheet, the support is at least 25 mm long and securely clamped to the anvil base to prevent slippage.

The anvil is fitted with a force transducer connected to the recording device so that its transmitted longitudinal force component can be measured and continuously recorded with an accuracy of ± 5 % during a blow on its surface.

The measuring system including the anvil assembly has a frequency response in accordance with channel class 1000 (ISO 6487).

6.8.3 Procedure

Inspect the measurement system using suitable calibration equipment before testing.

Fasten the helmet securely on the headform with its support system so that the peripheral vision requirements are satisfied. Raise the helmet assembly and drop it from a certain height (approximately 5.2 m) so that its velocity is $10\,^{+0,2}_{-0}$ m/second when it touched the anvil.

Observe continuously by means of the recording device the change in the transmitted anvil force during impact. Examine the helmet for damage that occurred at the spot due to impact on the helmet.

Test may be carried out on a single size of helmet to suit the size J headform, provided that the other sizes of the same helmet type are identical other than the shell size. Retesting of the helmet is necessary to ensure impact from every relevant direction. The shell rim does not constitute a projection for the purpose of this test.

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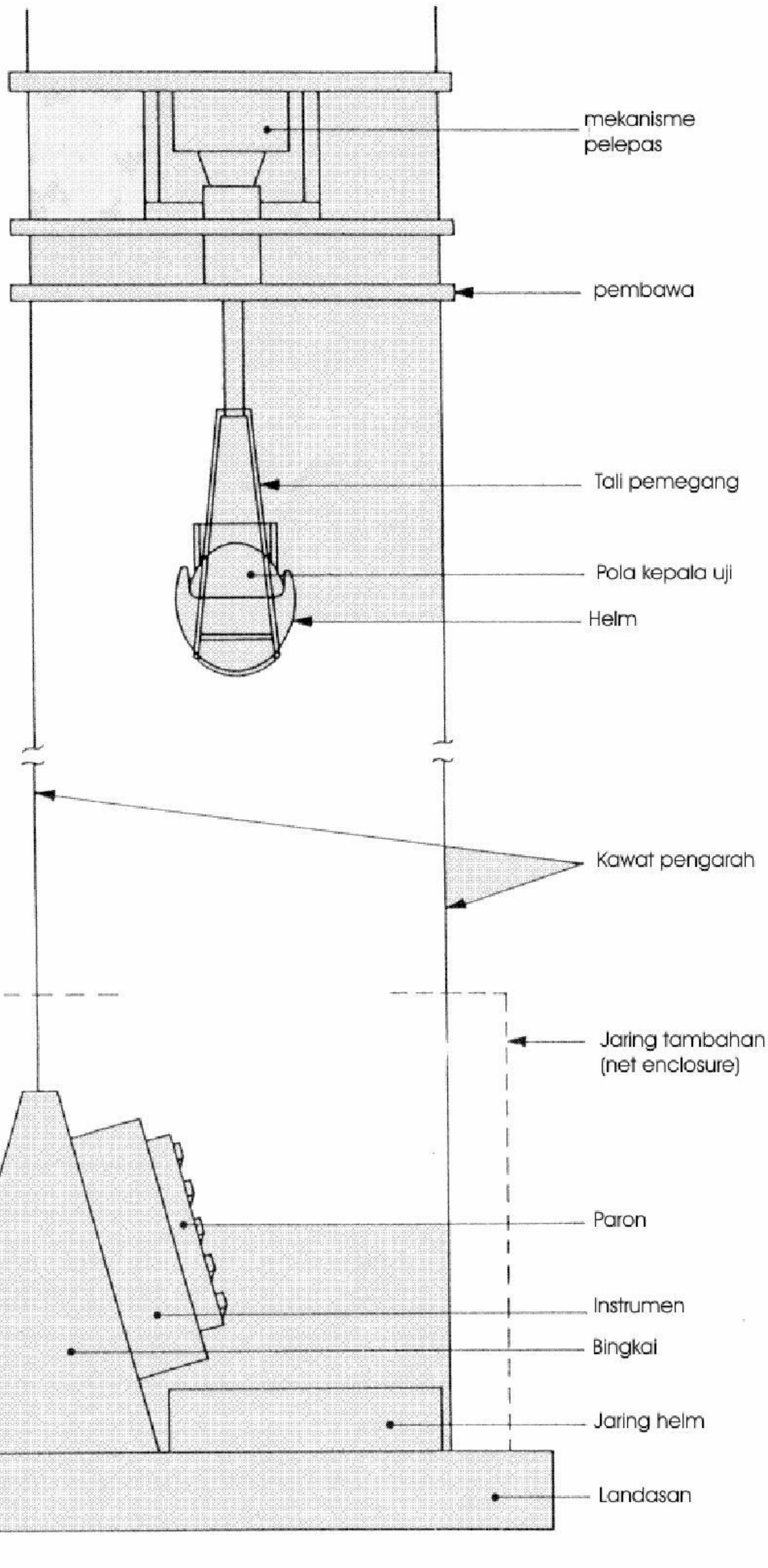


Figure 12 Oblique impact test apparatus

Mekanisme pelepas = Release mechanisme
Pembawa = Carriage
Tali pemegang = Straps
Pola kepala uji = Headform
Helm = Helmet
Kawat pengarah = Guide wires

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Jaring tambahan = Additional net enclosure
Paron = Anvil
Instrumen = Instrumentation
Bingkai = Frame
Jaring helm = Helmet net
Landasan = Anvil

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6.9 Chin guard test

6.9.1 Principle

The deceleration of a striker hitting the chin guard provides a measure of the ability of the chin guard to cushion blows. Observation is made on any damage.

6.9.2 Apparatus

A suitable apparatus is shown in Figure 13.

A rigid build support allows a complete headform complying to the standard to be supported from its neck, with the chin uppermost, so that the central transverse vertical plane of the headform makes an angle of 28 ° below the horizontal. The rear of the test helmet shell receives additional support from an adjustable block, covered by a layer 23 mm ± 1 mm thick made of vulcanized natural rubber with a Shore hardness of 70 $^{+5}_{-4}$ IRHD. The apparatus is mounted on a rigid base. A striker of mass 5,0 $^{+0,2}_{-0}$ kg and having a flat impact face with a diameter of 130 mm ± 3 mm carries an accelerometer with its sensitive axis within 5 ° of the vertical and can be dropped in guided fall as for the shock absorption test in 6.3.

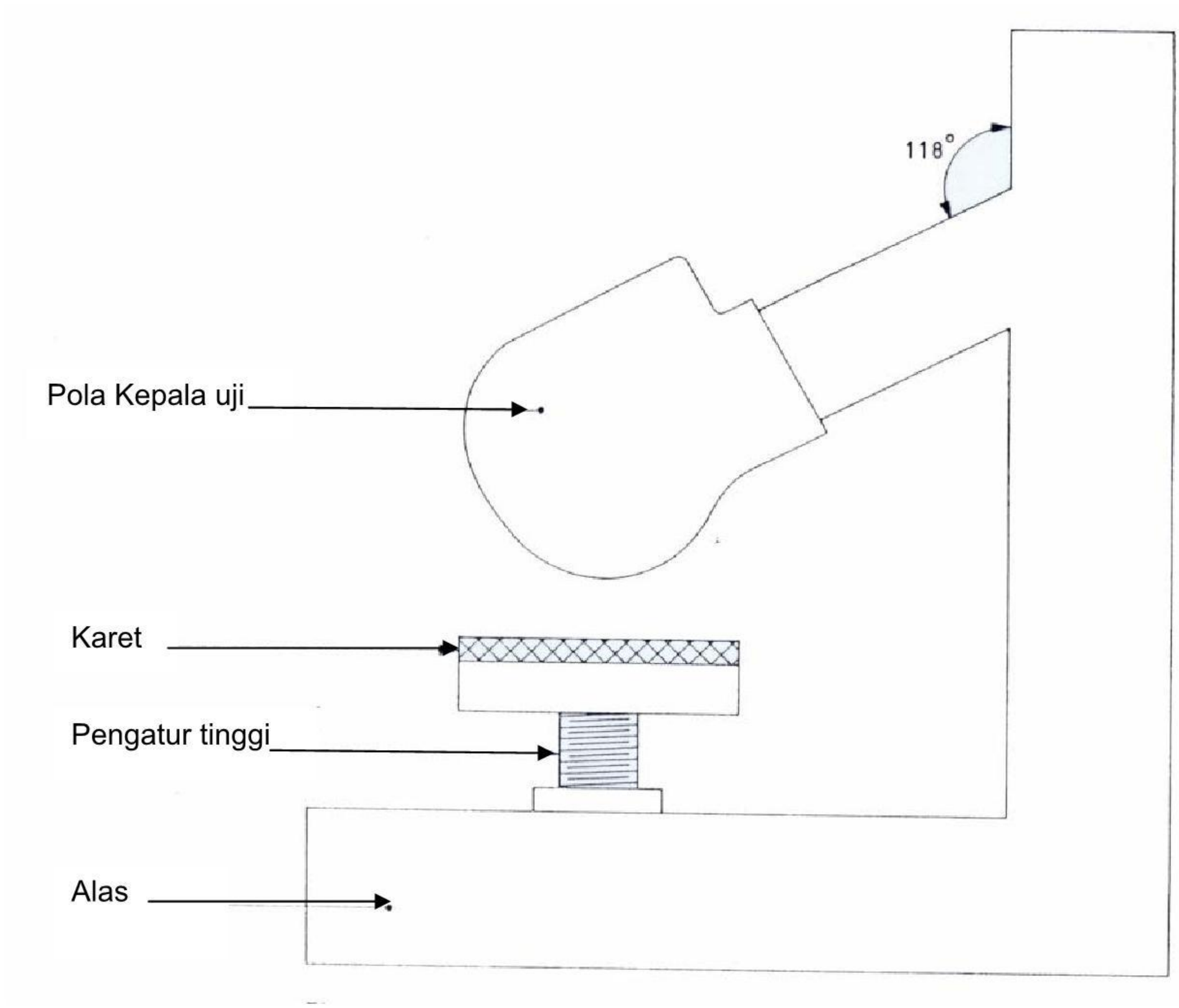


Figure 13 Apparatus for testing chin guard

Pola kepala uji = Headform
Karet = Rubber
Pengatur tinggi = Height adjustment

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Alas = Rigid base

6.9.3 Procedure

Test the helmet at ambient temperature. The helmet used for this test may have undergone other tests (for example shock absorption, oblique impact) but shall, in any case, have undergone solvent conditioning as specified in 6.1.2.
Place the helmet on the headform and adjust it to satisfy the peripheral vision requirements in 6.1.5. Secure the resistance system firmly and raise the adjustable support to contact the rear external part of the helmet shell. Drop the striker from a height of 2,5 m ± 5 mm (measured from the striker face to the highest point of the chin guard). Record the peak deceleration of the striker and examine the chin guard and its lining for damage.

6.10 Test for flammability

6.10.1 Principle

A flame is applied to parts of the helmet and observe whether melting, burning and continued burning process occured.

6.10.2 Apparatus

The apparatus consists of gas supplies containing at least 95% propane with an on/off valve, a pressure regulator, a manometer and a suitable gas burner with a bore diameter of 10 mm ± 1 mm.

7 Acceptance requirements

The helmet is accepted whenever all requirements in clause 4 as summarized in Table 5 are complied with.

Table 5 Performance requirements of helmets

No	Test	Test methode	Requirements	Notes
1	Shell	Shock absorption (clause 6.2)	The maximum deceleration of the headform shall not exceed 300*g* (*g* = gravity acceleration)	
		Penetration (clause 6.3)	No contact shall occur with the test block at any point on the helmet to the limit of rotation of the helmet.	
2	Retention system	Strength of retention system (clause 6.5)	First impact : Dynamic extension = 32 mm, residual extension = 16 mm; Second impact: Dynamic extension = 25 mm, residual extension = 8 mm	
		Strap smoothness (clause 6.6)	The slippage through the grip shall not exceed 10 mm	
		Strap wear (clause 6.7)	The strap shall not fail; and shall withstand a load if the slippage exceeds 5 mm	

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Table 5 (continuation)

No	Test	Test methode	Requirements	Notes
3	Oblique impact	Flat anvil (clausel 6.8)	The peak longitudinal force measured shall not exceed 2,5 kN nor shall its integral with time exceed 15,5 N.s for any impact	
		Abrasive anvil (clause 6.8)	The value observed for peak longitudinal force and for its time integral shall not differ between selected areas by a factor greater than 2,0 for values of peak longitudinal force (minimal 1,75 kN)	
4	Chin guard	Chin guard (clause 6.9)	Maximum deceleration of 300 *g* (g = gravity acceleration)	

8 Marking

The product shall at least bear the following information :
a. trade mark or logo;
b. the name of the manufacturer;
c. type/model;
d. size

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